



## SIGNALS+SOFTWARE

# ETSI FR-GSM Speech Coder



### Processor

Texas Instruments TMS320C6000 DSP range.

### Background

The algorithm implemented is the ETSI Full-Rate (FR) GSM recommendation, digital mobile telephone system. The encoder compresses linear-PCM (Pulse Code Modulated), narrowband speech input data, at a sample rate of 8kHz, to 13 000 bps, and uses a Regular Pulse Excitation with Long-Term Prediction (RPE-LTP) algorithm. The software will include voice activity detection, error concealment, and discontinuous transmission facilities.

The FR-GSM algorithm implements silence compression techniques to reduce the transmitted bit rate during the silent intervals of speech. Systems allowing discontinuous transmission (DTX) are based on Voice Activity Detection (VAD) algorithms and Comfort Noise Generator (CNG) algorithms that allows the insertion of Silence Insertion Descriptor (SID) frames during the silence intervals. This also provides the additional advantage of using lower processing loads and DSP bandwidth resource during silence frames.

### Features and Performance

- TI eXpressDSP™ Compliant software available
- 110 channels of FR-GSM on 200MHz device
- Passes all ETSI FR-GSM test vectors.

FR-GSM	Program Memory		Data Memory			Interrupt Latency (Cycles)	Typical call Period (ms)	Processing Load (MHz)
	Code (Kbytes)	Tables (Kbytes)	Static Memory		Stack Memory (Kbytes)			
			Heap (Kbytes)	Tables (Kbytes)				
Encoder	19.97	0.05	n * 0.70	0.44	1.35	6960	20	n * 1.39
Decoder	7.88	0.05	n * 0.47	0.26	0.46	1980	20	n * 0.42
Encoder + Decoder	25.97	0.10	n * 1.17	0.53	1.35	6960	20	n * 1.81

Table 1 : DSP Requirements for FR-GSM

**Note:** Processing loads quote worst-case scenarios with n representing the number of channels. Program memory table values are initialisation values. Kbytes equals 1024 bytes.

### Technical Notes

The software is written using only fixed-point instructions and is compatible with both the TMS320C6000 fixed-point family and the TMS320C6700 floating-point family. It can operate in either big-endian or little-endian mode, with the selection being made at build time.

The following ETSI specifications will be implemented: 06.10 (speech transcoding), 06.11 (substitution and muting of lost frames), 06.12 (comfort noise), 06.31 (discontinuous transmission) and 06.32 (voice activity detection).

### Interface Details

The eXpressDSP™ FR-GSM software uses an interface defined by **SIGNALS+SOFTWARE** that is similar to the other vocoder interfaces specified by Texas Instruments in the eXpressDSP™ developer's kit.

The software is also available in a non-eXpressDSP version with a basic multi-channel interface. The DSP requirements for this version are similar to those given in Table 1.

### Availability

The code is available now, for a one-off payment and/or royalties depending on the commercial application.

Software for the TMS320C6000 is available for a range of GSM vocoders including AMR-GSM, EFR-GSM, and for other communication algorithms. FR-GSM is also available for the TMS320C5000.

## SIGNALS+SOFTWARE

**SIGNALS+SOFTWARE** was founded in 1992 as a developer of high quality Digital Signal Processing application software for the communications industry. Supplying to a whole range of customers, including large blue chip corporations, **SIGNALS+SOFTWARE** has quickly established itself as the world leader in DSP software design and production.

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